DOCUMENT RESUME

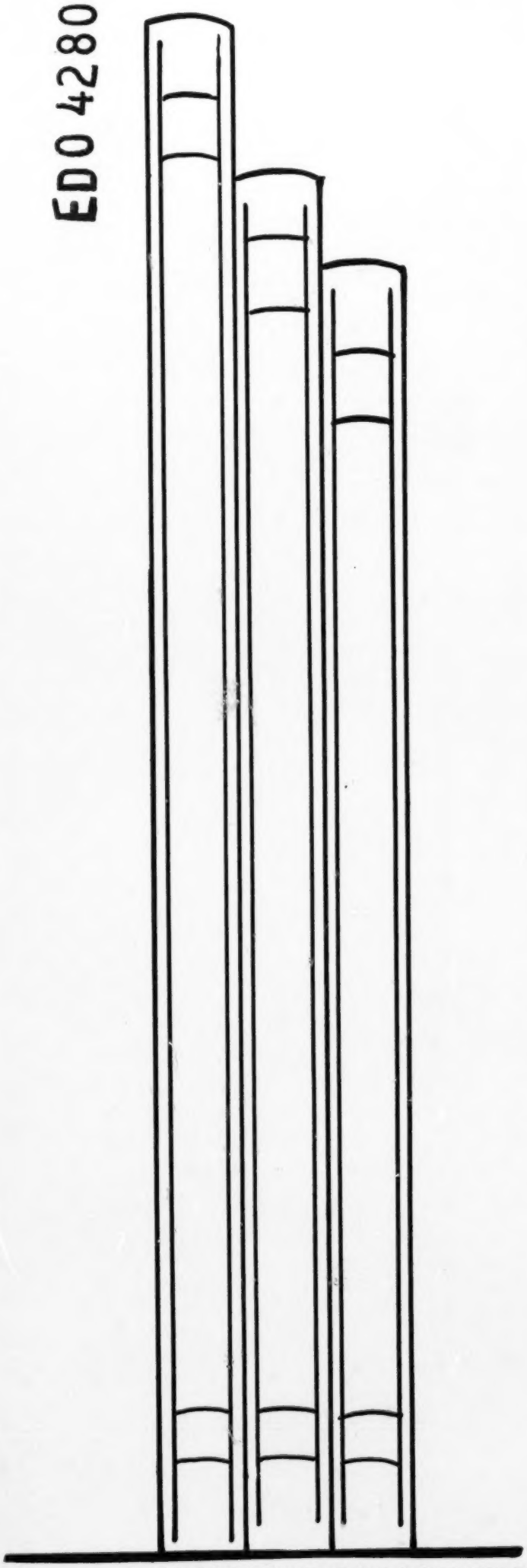
ED 042 800 TM 000 059

AUTHOR	Wohlferd, Gerald
TITLE	Toward an Evaluation of Education: A Description of the Quality Measurement Project. Second Edition.
INSTITUTION	New York State Education Dept., Albany. Bureau of School Programs Evaluation.
SPONS AGENCY	New York State Univ. System, Albany.
PUB DATE	Sep 69
NOTE	34p.
EDRS PRICE	EDRS Price MF-$0.25 HC-$1.80
DESCRIPTORS	*Comparative Statistics, *Evaluation Criteria, *Evaluation Techniques, Grade Equivalent Scores, Intelligence Quotient, Multiple Regression Analysis, National Norms, Parental Background, Predictor Variables, Rural Urban Differences, School Statistics, Socioeconomic Background, *State Programs, Statistical Studies
IDENTIFIERS	Iowa Tests of Basic Skills, Lorge Thorndike Intelligence Test, *New York State School Systems, Quality Measurement Project

ABSTRACT

The Quality Measurement Project was established in 1956 by the New York State Education Department to determine the feasibility of measuring quality differences between schools and of identifying variables related to these differences. In the latest revision of the project, begun in 1964, 99 representative school systems, excluding the New York City school system, administered tests at grades 5 and 8. Distinctions were drawn between national and state norms on the Iowa Tests of Basic Skills and the Lorge-Thorndike Intelligence Test. Comparisons were made between school system groups based on system size, average I.Q., and average level of mother's education, father's education, and father's occupation. Likewise student groups were compared on I.Q., mother's education, father's education, and father's occupation. As a result of these studies and further correlations, three methods of school system evaluation are suggested: comparison of school system average score with several state subgroup norms, comparison of local subgroup average scores with similar state subgroup scores, and the prediction of a local average score by use of regression analysis and a nomograph. The study is supplemented with comprehensive graphs and illustrations. (DG)

ED042800



TOWARD AN EVALUATION OF EDUCATION

- A DESCRIPTION OF THE QUALITY MEASUREMENT PROJECT

- SECOND EDITION

THE UNIVERSITY OF THE STATE OF NEW YORK • THE STATE EDUCATION DEPARTMENT
BUREAU OF SCHOOL PROGRAMS EVALUATION ALBANY, NEW YORK SEPTEMBER, 1969

U.S. DEPARTMENT OF HEALTH, EDUCATION
& WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

ED042800

TOWARD AN EVALUATION OF EDUCATION

A Description of the Quality Measurement Project, Second Edition

SP 000 057

The University of the State of New York
THE STATE EDUCATION DEPARTMENT
Bureau of School Programs Evaluation
Albany, New York
September 1969

THE UNIVERSITY OF THE STATE OF NEW YORK

Regents of the University (with years when terms expire)

1984 Joseph W. McGovern, A.B., LL.B., L.H.D., LL.D., D.C.L.,
Chancellor - New York

1970 Everett J. Penny, B.C.S., D.C.S.,
Vice Chancellor - - - - - - - - - - - - - - - - - - White Plains

1978 Alexander J. Allan, Jr., LL.D., Litt.D. - - - - - - - Troy

1973 Charles W. Millard, Jr., A.B., LL.D., L.H.D. - - - - Buffalo

1972 Carl H. Pforzheimer, Jr., A.B., M.B.A., D.C.S.,
H.H.D. - Purchase

1975 Edward M. M. Warburg, B.S., L.H.D. - - - - - - - - - New York

1977 Joseph T. King, LL.B. - - - - - - - - - - - - - - - Queens

1974 Joseph C. Indelicato, M.D. - - - - - - - - - - - - - Brooklyn

1976 Mrs. Helen B. Power, A.B., Litt.D., L.H.D. - - - - - Rochester

1979 Francis W. McGinley, B.S., LL.B., LL.D. - - - - - - Glens Falls

1980 Max J. Rubin, LL.B., L.H.D. - - - - - - - - - - - - New York

1971 Kenneth B. Clark, A.B., M.S., Ph.D., Litt.D. - - - - Hastings
on Hudson

1982 Stephen K. Bailey, A.B., B.A., M.A., Ph.D. LL.D. - - Syracuse

1983 Harold E. Newcomb, B.A. - - - - - - - - - - - - - - Owego

1981 Theodore M. Black, A.B. - - - - - - - - - - - - - - Sands Point

President of the University and Commissioner of Education
Ewald B. Nyquist

Associate Commissioner for Research and Evaluation
Lorne H. Woollatt

Assistant Commissioner for Research and Evaluation
William D. Firman

Director, Division of Evaluation
Alan G. Robertson

Chief, Bureau of School Programs Evaluation
David J. Irvine

FOREWORD

Determining the effectiveness of educational systems is one of the major problems facing society today. The importance of educational evaluation is emphasized by the increasing scrutiny being given to expenditures for education and to the performance of educational systems.

The Quality Measurement Project (Q.M.P.) was part of the on-going effort of the New York State Education Department to develop better methods of assessing the effectiveness of educational programs. The major action of Q.M.P. began in 1958. The 1965 phase of this project, described in the present report, as well as the earlier phases of the project are important for three major reasons. First, they looked at school performance in relation to other variables (such as socioeconomic status and student I.Q.) which appear to influence students' performance. Second, school systems were compared with school systems like themselves. Finally, the project proved that data could be collected and recorded in such a manner as to lend them to computer processing, whereby administratively pertinent individual district reports would emerge quickly and accurately.

The Q.M.P. data has subsequently been merged with the information supplied by the New York State Pupil Evaluation Program (PEP). The former provided evaluative data based upon nationally standardized tests; the latter, information based upon special tests of achievement developed by the State Education Department which were geared to New York State goals and curricula. The two streams of test data were merged into Performance Indicators in Education (PIE).

Parallel in time of development is the Basic Educational Data Systems (BEDS). It provides data about pupils, school staffs, program, finance, and facilities. Thus, it was natural that Q.M.P., PIE, and BEDS

should be combined at a key point in time. The inception of high-speed computer capacity in the Department makes the merger possible. Consequently, a System of Educational Evaluation (SEE) is now being designed. It will be increasingly helpful to decision-makers at the State and local levels.

Gerald H. Wohlferd, author of this report, planned and directed the testing, compilation, and report preparation of the 1965-1966 phase of the project. The late Mary Harris was indispensible in supportive roles as were the programming talents of James Carter. Mrs. Lynne Curtis, too, took part in the production of this report as she was responsible for the preparation of many of the charts included herein.

LORNE H. WOOLLATT
Associate Commissioner
for Research and Evaluation

Table of Contents

	Page
Introduction	1
Comparisons Based on New York State Averages	3
Comparisons Based on School System Averages	6
Comparisons Between Student Groups	12
Relationship of Achievement to Other School System Measures	16
Evaluation of School System Achievement	20
Conclusion	28

TOWARD AN EVALUATION OF EDUCATION

A Description of the Quality Measurement Project, Second Edition

Introduction

In an effort to answer the increasingly frequent question, "How good are our schools?", the New York State Education Department established the Quality Measurement Project in 1956. The project was designed to determine whether it was possible to measure quality differences among schools and, if so, to identify variables related to these differences. Parallel to this was the objective of developing methods which local school system officials could utilize in educational planning and decision making. To this end 100 school systems were included in a mass testing program of achievement and intelligence which extended over a 4-year period. As a result of the testing and subsequent data analyses, the School Quality Workbook was published in 1963.

A revision of the Quality Measurement Project was begun in 1964 to update the norms in the workbook and to take advantage of a new edition of the achievement test used in the earlier project. In the fall of 1965, 99 school systems throughout the State administered Form 4 of the Iowa Tests of Basic Skills to students in the fifth and eighth grades. More than 45,000 students were tested. The school systems were widely scattered geographically (Figure 1), representing communities of different sizes and socioeconomic characteristics. Although several school systems in the New York City metropolitan area were included, the New York City school system was not. It should be noted that the school systems included in the project were selected purposively so as to be representative of upstate New York and cannot be assumed because of the omission of New York City to comprise a sample which is representative of New York State.

The Iowa Tests of Basic Skills battery is made up of the following tests and subtests:

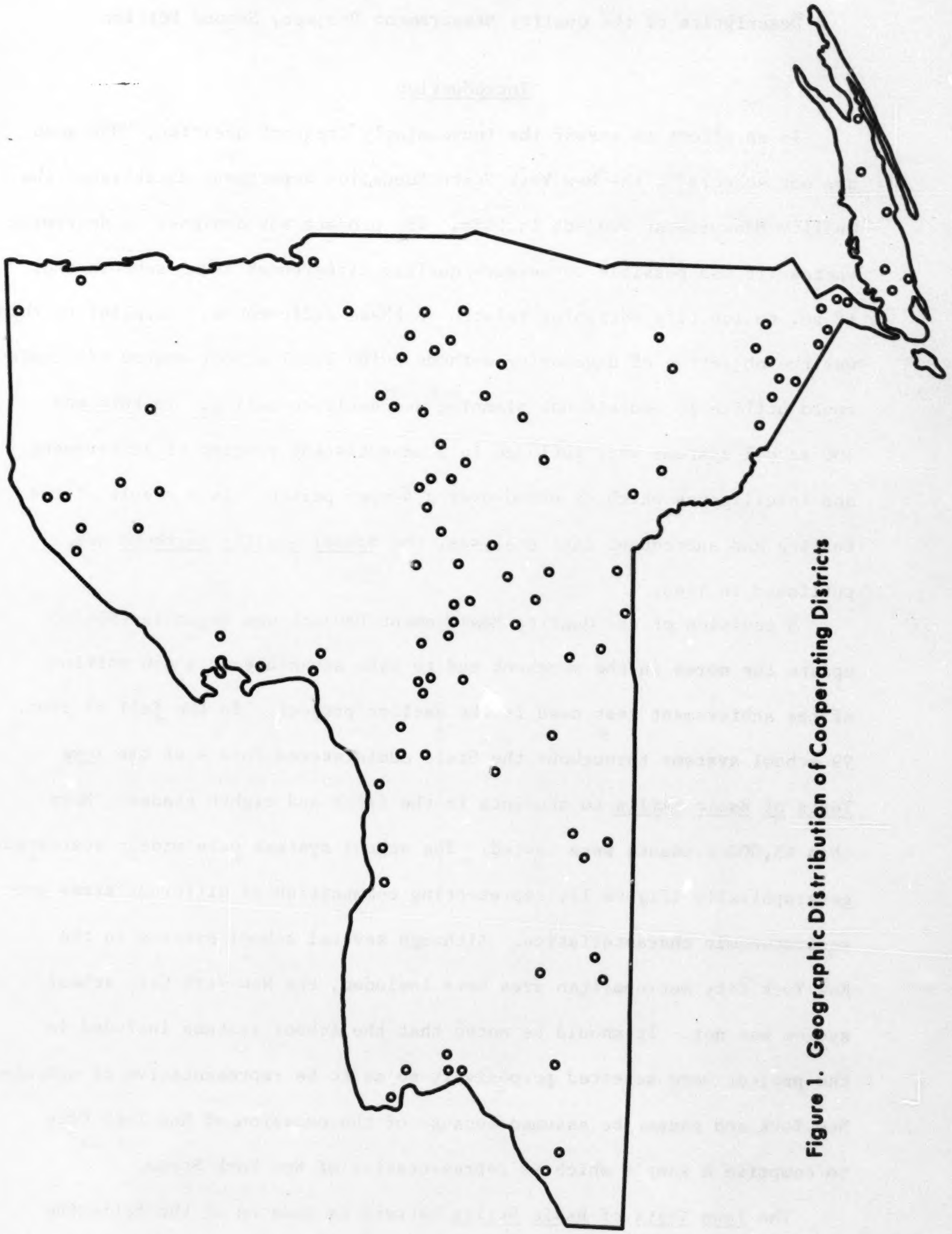


Figure 1. Geographic Distribution of Cooperating Districts

Vocabulary

Reading

Language (average of the subtests below)

- Spelling
- Capitalization
- Punctuation
- Usage

Work Skills (average of the subtests below)

- Map Reading
- Reading Graphs and Tables
- Use of Reference Materials

Arithmetic (average of the subtests below)

- Arithmetic Concepts
- Arithmetic Problem Solving

Composite (average of the five major test areas)

In addition to achievement test scores, various other types of data were gathered. For each student, information was recorded concerning his sex, the educational attainment of both parents, the occupation of his father, and the type of community in which he lived. The Lorge-Thorndike Intelligence Test scores were recorded for each child if they were available.

The present report will describe in nontechnical terms some of the findings of the 1965 project.

Comparisons Based on New York State Averages

A major concern of citizens of New York State is the educational attainment of their children. A rough indication of how students in this State compare with students elsewhere can be obtained by relating their scores to norms established by test developers. Because these norms are based on samples which are intended to be representative of students across the Nation, they may approximate national norms. In the discussion and figures which follow, the

term national norms refers to the test publisher's norms. The term New York State averages refers to averages based on the sample of school systems included in this project.

The Iowa Tests of Basic Skills were administered in the fall of 1965, with most of the 99 school systems testing in October or November. The average grade-equivalent score for this time of testing, according to national norms, should thus be 5.2 for the fifth grade and 8.2 for the eighth. The average composite achievement scores for students in New York State were 5.4 for the fifth grade and 8.4 for the eighth. Comparing these two sets of average scores reveals that students in this State scored 2 months higher than the national average in both the fifth and the eighth grades (Figure 2).

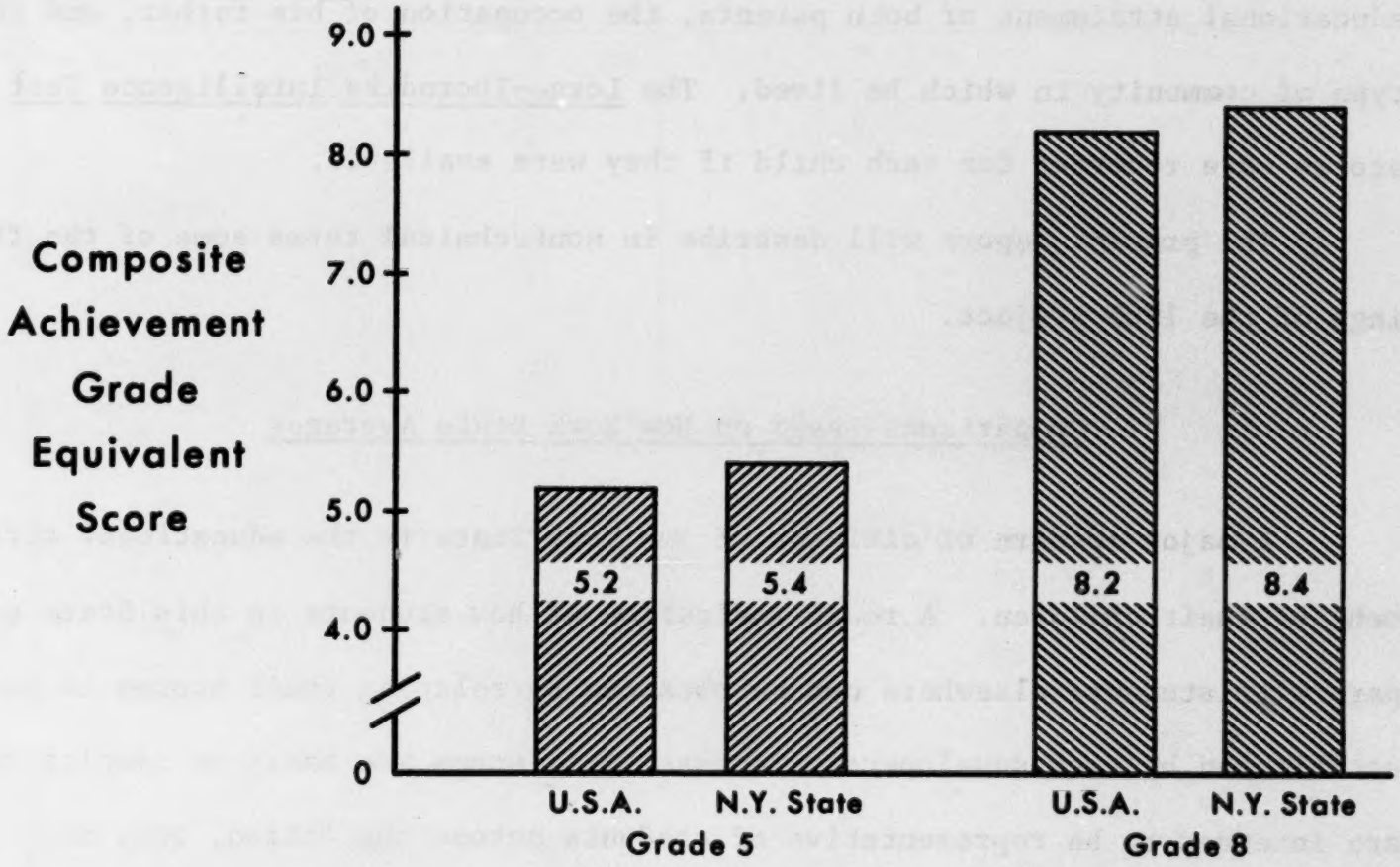


Figure 2. Average Composite Achievement of New York State and the Nation, Fall 1965

Such composite scores are useful for obtaining a picture of overall achievement. However, subtest scores provide a more precise picture of areas of strength and weakness. Figure 3 shows the differences between New York State average scores in the various subject areas included in the Iowa Tests of Basic Skills at the fifth grade. While some caution must be exercised in making comparisons between subtest scores, it appears that New York State students were strongest in language achievement and weakest in arithmetic achievement, although still above the national average in the latter area.

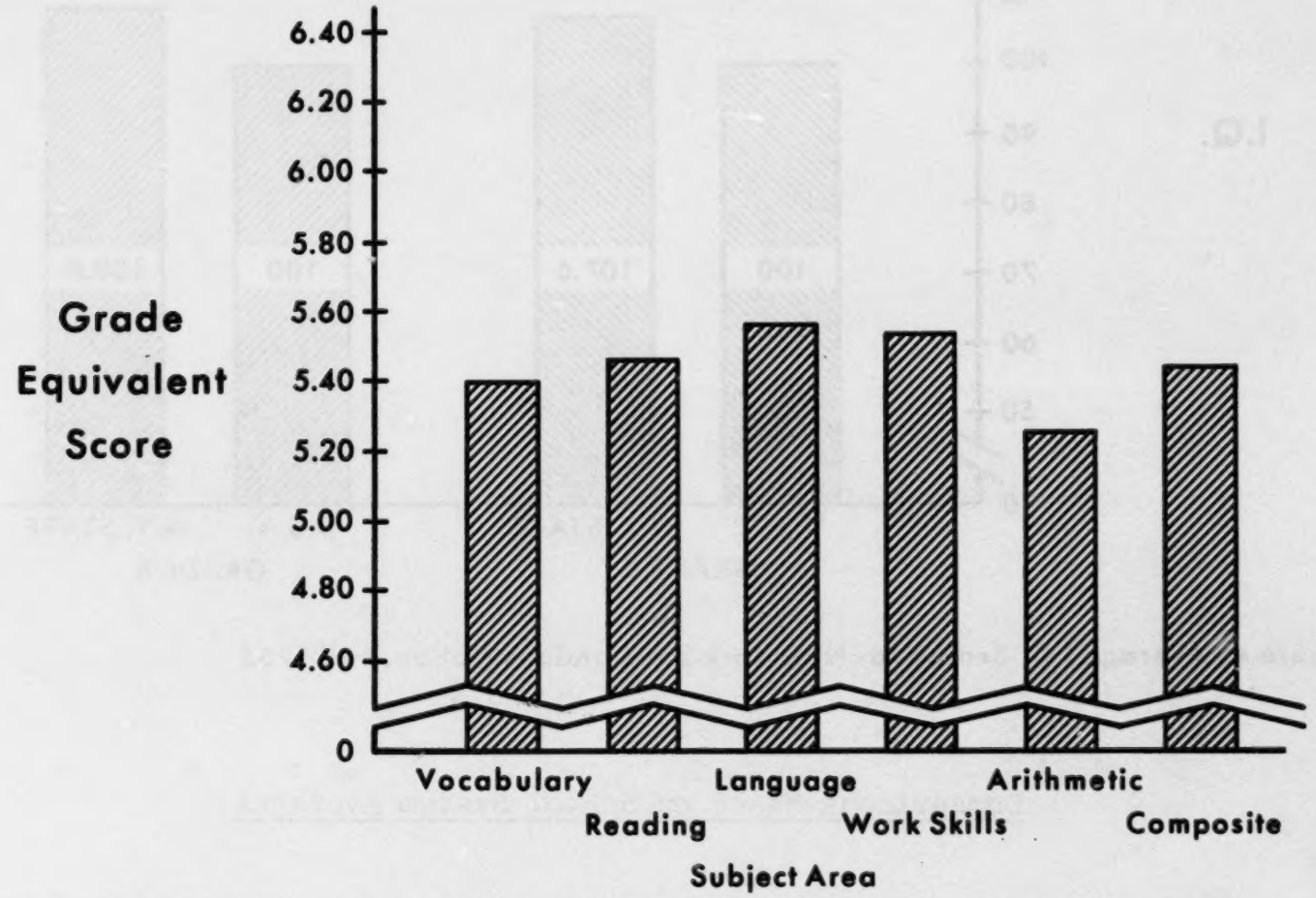


Figure 3. New York State Average Achievement Scores by Subject Area, Grade 5

The average I.Q. score on most intelligence tests is approximately 100, regardless of the age or grade level of the person taking the test. The average I.Q. of New York State students included in past studies of the Quality Measurement Project was above the national average at all grade levels and tended to be higher at the upper grade levels.

Data collected in the fall of 1965 indicated that the average I.Q. scores for New York State students were above the national average (Figure 4). At the fifth-grade level, New York State students averaged nearly eight points above the national average and at the eighth-grade level, approximately nine points above.

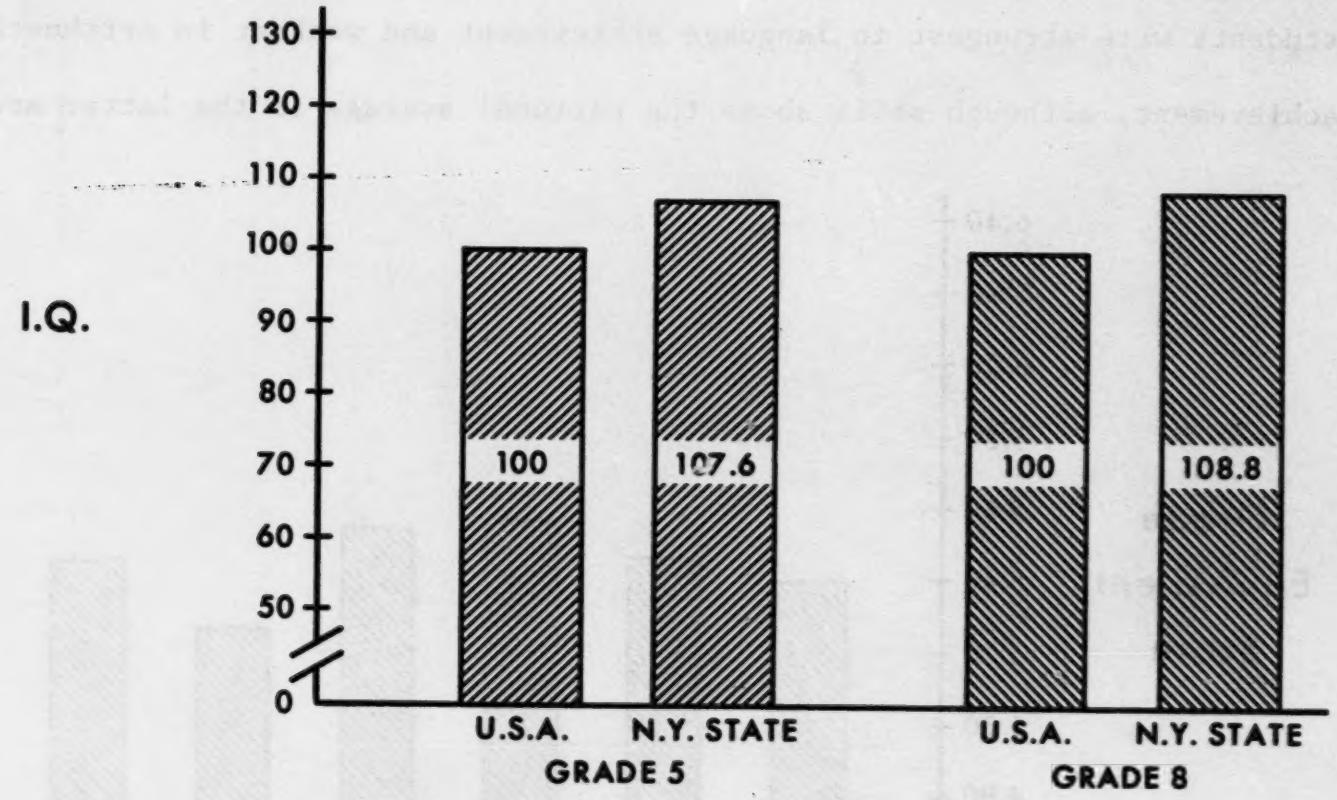


Figure 4. Average I.Q. Scores for New York State and the Nation, Fall 1965

Comparisons Based on School System Averages

Several pupil and community characteristics appear to be related to differences in the average scores of school systems. Separating systems into groups according to the legal designation of each district (primarily a size distinction) reveals differences in average composite achievement (Figure 5).* The large

*In each of the following figures, the middle horizontal line represents the average score, while the dark rectangular area covers the middle 50 percent. Thus, the upper edge of the shaded rectangle indicates the point above which the highest scoring 25 percent of the school systems fell; the lower edge, the point below which the lowest scoring 25 percent of the school systems fell.

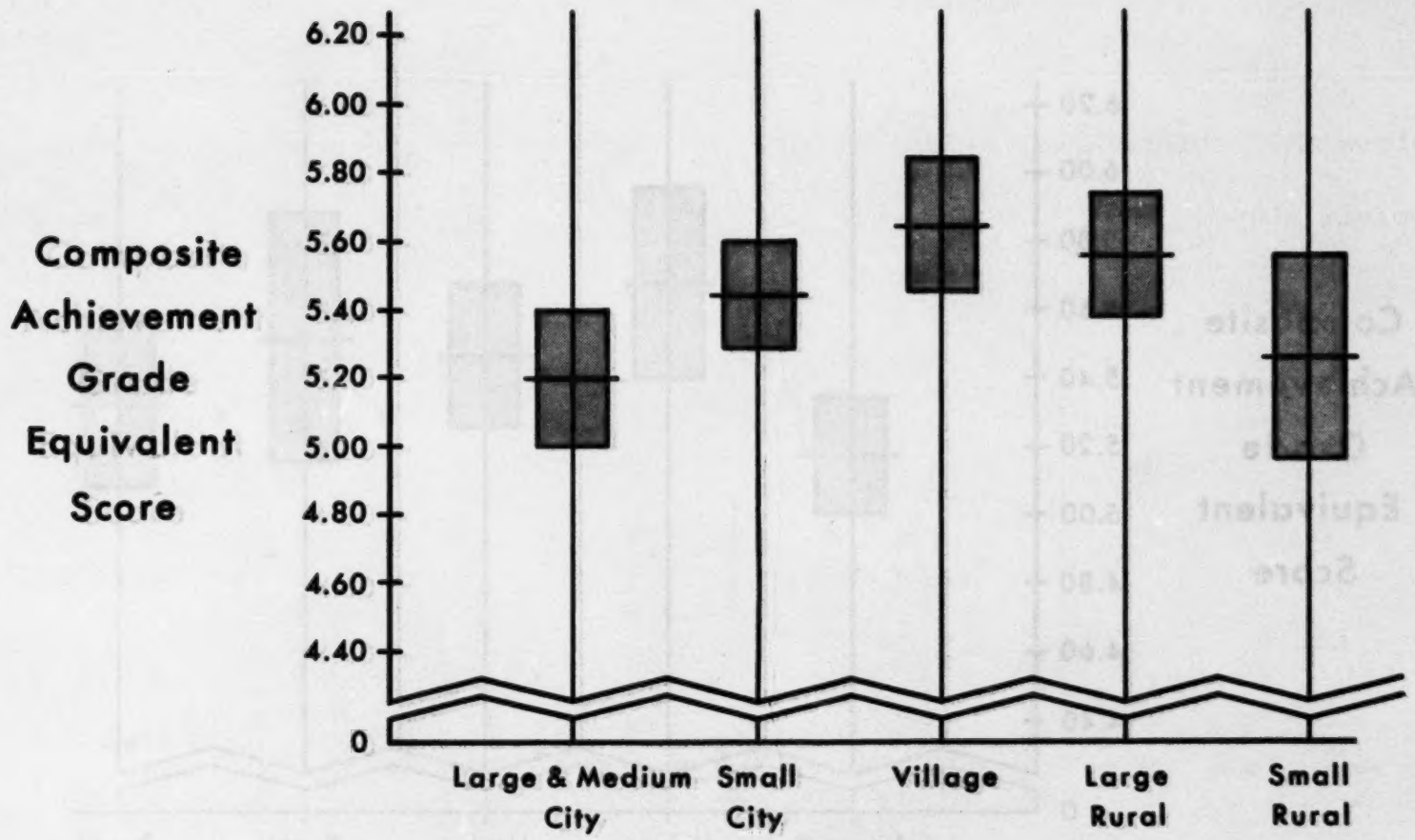


Figure 5. School System Type by Legal Designation and Composite Achievement, Grade 5

and medium city school systems ranked lowest followed closely by small rural systems. Village systems, which contain many suburban school systems, made up the highest ranking group. Size alone is not the determining factor since, as can be seen, large and medium city systems and small rural systems (which fall at the extremes in terms of size) both generally scored low.

Grouping school systems according to degree of urbanness also reveals differences between groups. Figure 6, in which school systems are grouped according to the U.S. Census method, indicates that the large and medium cities, and the rural type community had lower composite achievement scores. Those urban metropolitan communities which surround the large metropolitan centers, had the highest average composite achievement scores. Those of a more rural

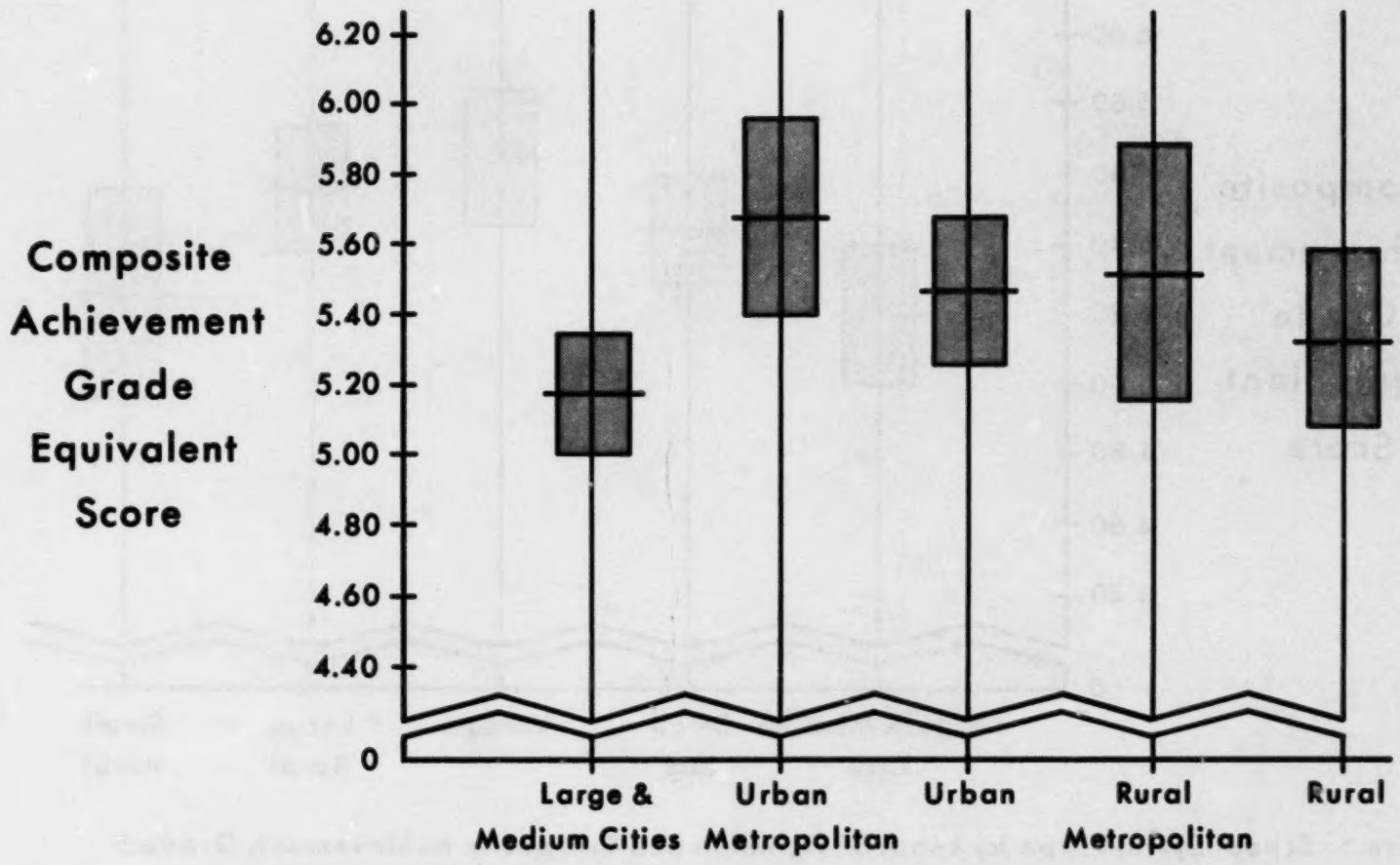


Figure 6. Community Type by Census Classification and Composite Achievement, Grade 5

character (rural metropolitan), but still near the large metropolitan centers, also showed generally high average composite achievement scores. The length of the shaded rectangular area which represents the middle 50 percent of the distribution indicates that there is a greater diversity of average achievement among the rural metropolitan school systems than among the other types of systems.

When schools are grouped according to level of average I.Q., differences between groups in average composite achievement are apparent.

In Figure 7, the high I.Q. group contains school systems with average I.Q. scores on the Lorge-Thorndike Intelligence Test between 140 and 110, the middle I.Q. group contains systems with average I.Q. scores between 103 and

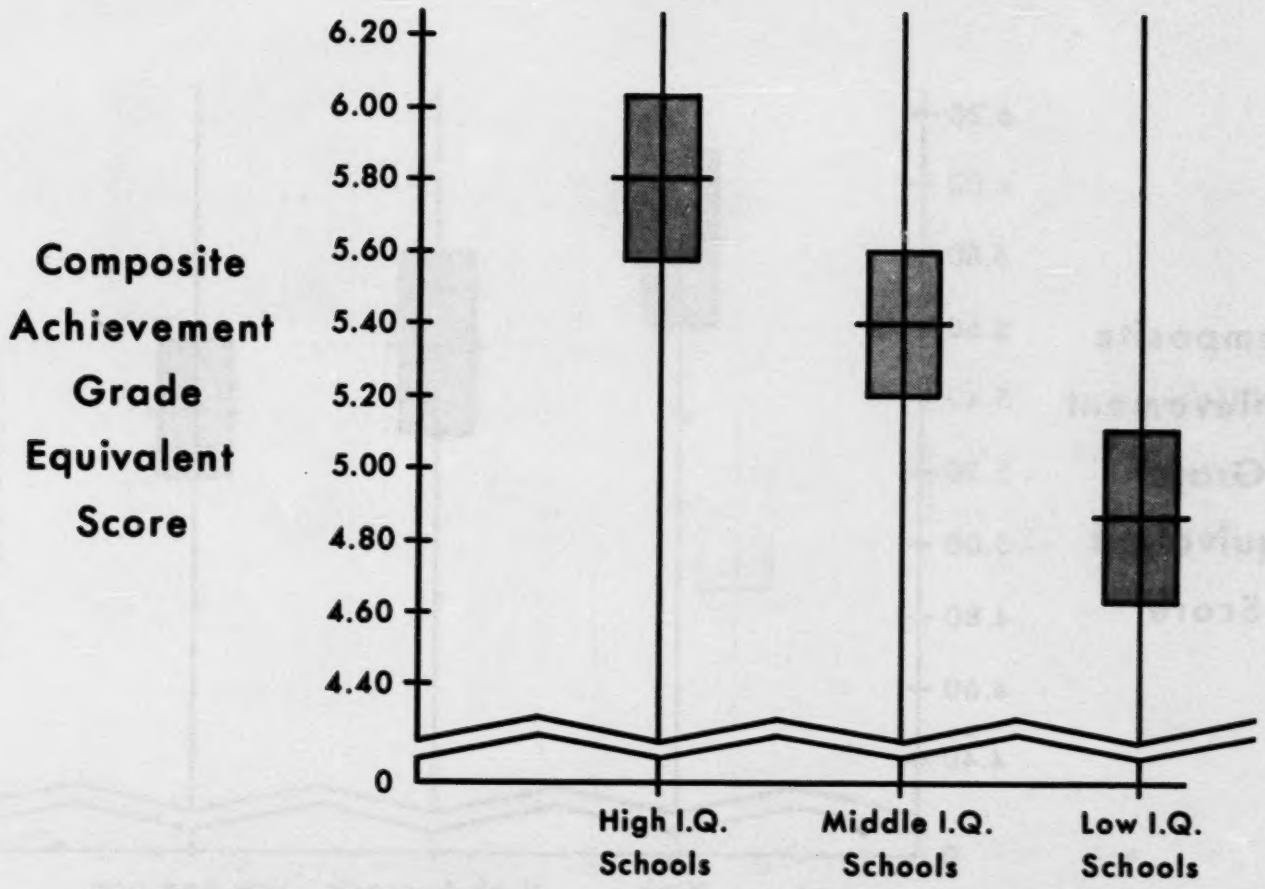


Figure 7. Average School System I.Q. and Composite Achievement, Grade 5

109.9, and the low I.Q. group contains systems with average I.Q. scores below 103. The average composite achievement of the low I.Q. group is approximately 4.85, well below the national norm of 5.2. There is a difference of almost one grade equivalent between the high group and the low group. Apparently the I.Q. of a student body is closely related to the level of achievement of the group.

Figures 8 through 10 illustrate other relationships between school system background and achievement. Each of the figures deals with a slightly different measure of family social and economic level. Figure 8 illustrates the relationship of the student's mother's education by school system with average school system composite achievement. The father's education average by system in Figure 9 shows much the same pattern of achievement. Those school systems with the highest average level of parents' education show the highest average composite achievement scores.

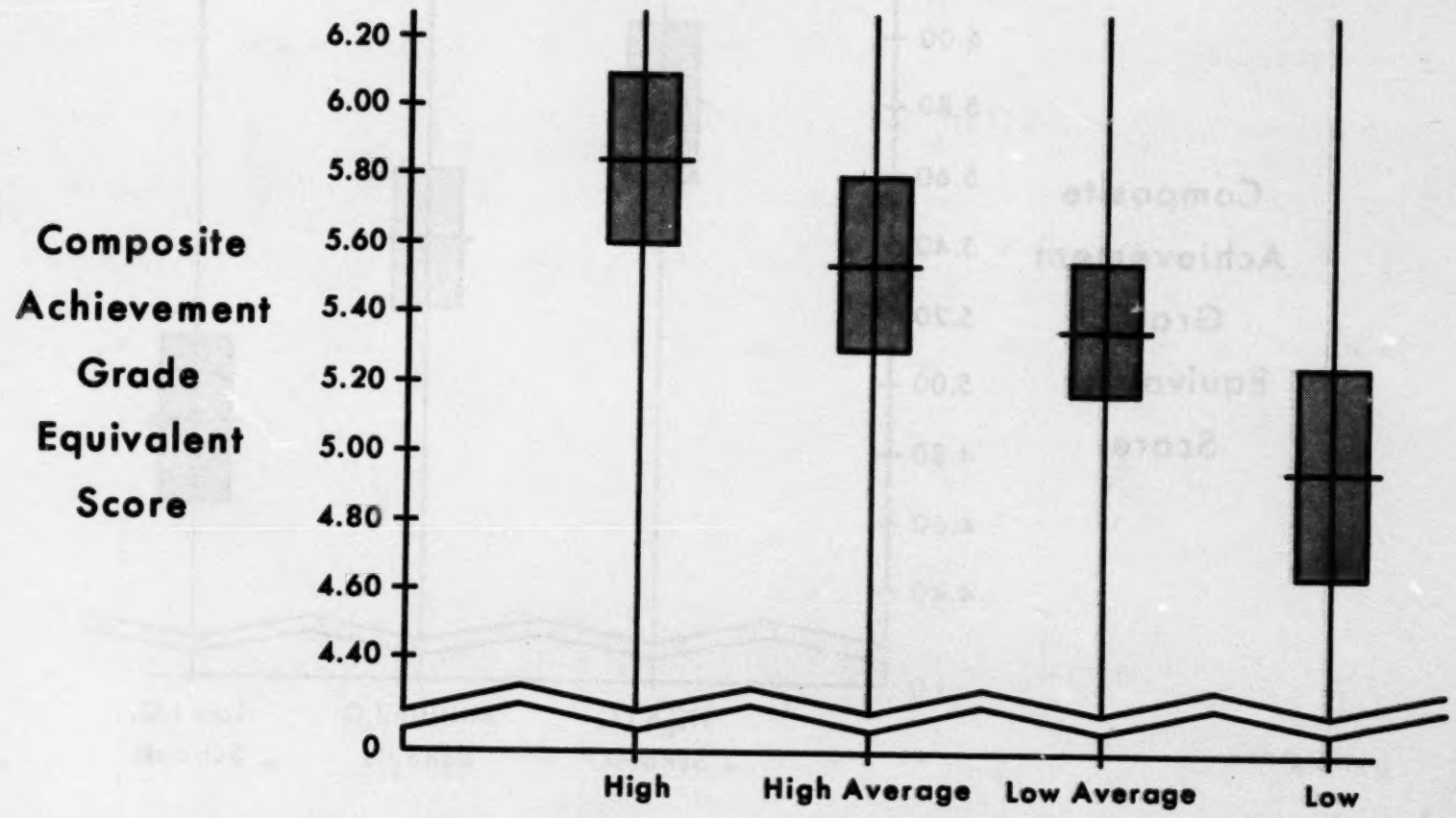


Figure 8. Mother's Education and Composite Achievement, Grade 5

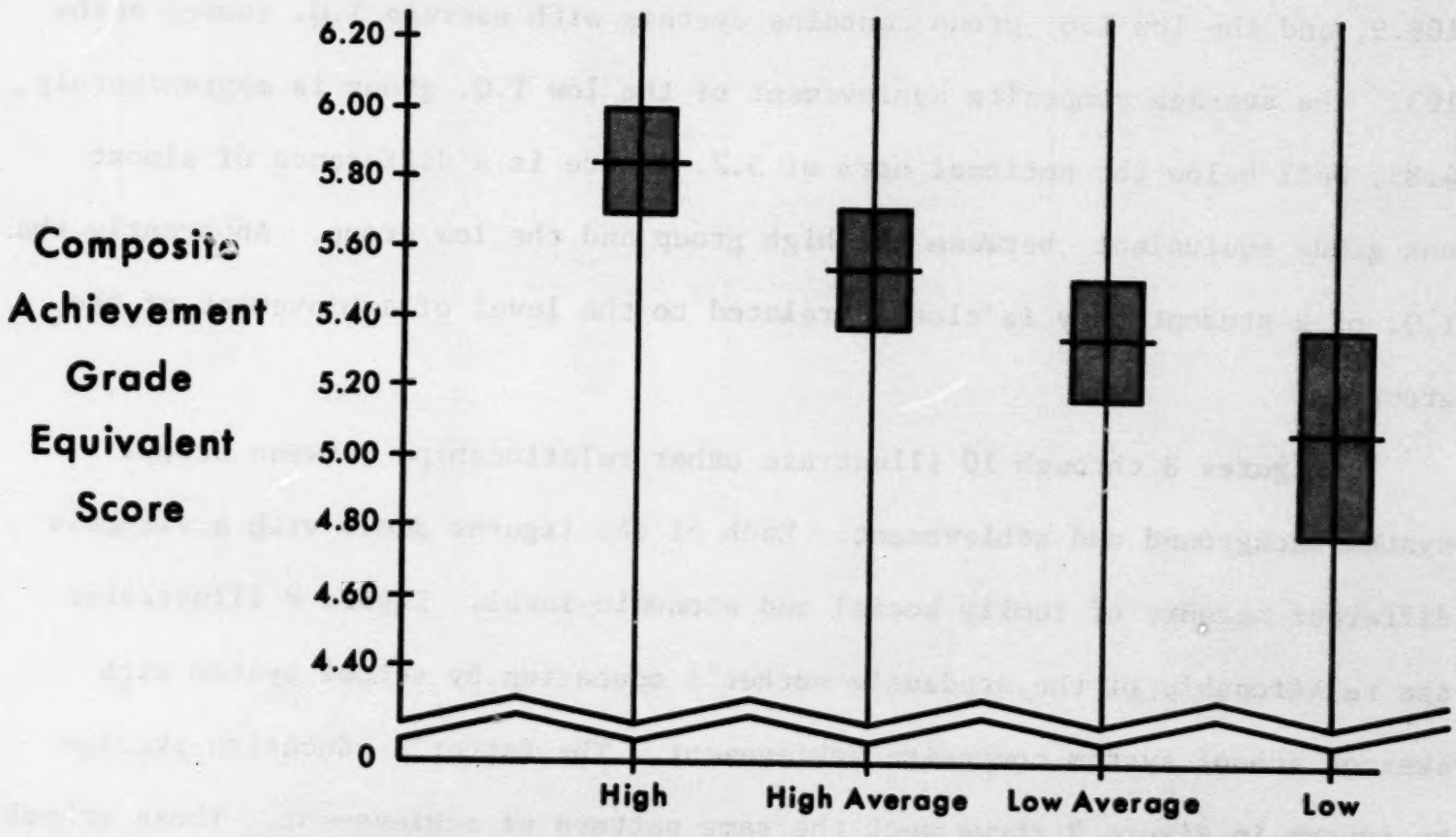


Figure 9. Fathers Education and Composite Achievement, Grade 5

Figure 10 also deals with a socioeconomic measure, in this case average father's occupational level. Occupations most often appearing in the high group are professional and managerial in nature, while those in the low category are mainly semiskilled and unskilled positions. It can be readily seen from Figure 10 that the general occupational level of the population from which the school system draws its students relates to the achievement level of those students.

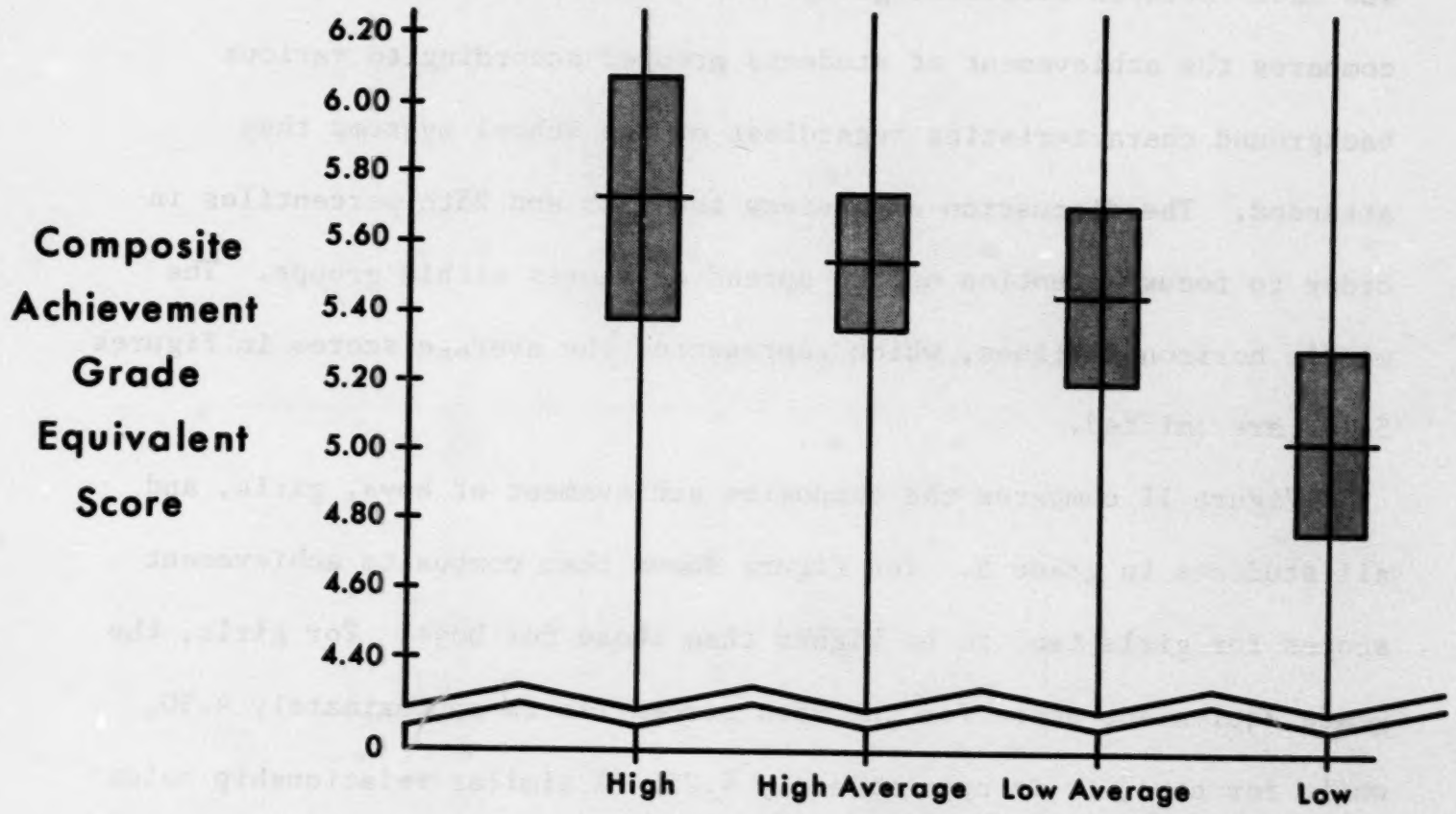


Figure 10. Father's Occupation and Composite Achievement, Grade 5

These data illustrate the relationship of both level of ability and socioeconomic status of pupils to achievement. It is clear that, in order to evaluate realistically the effectiveness of a school system, these factors must be considered.

Comparisons Between Student Groups

The previous two sections of this report described two kinds of comparisons: 1) comparisons of average scores of the New York State 1965 Quality Measurement Project sample with national (i.e., test publishers') norms; and 2) comparisons of average scores of school systems which have been grouped in different ways. To provide a more complete description of the results of this study, a third type of comparison was made--between different groups of students. The present section compares the achievement of students grouped according to various background characteristics regardless of the school systems they attended. The discussion emphasizes the 75th and 25th percentiles in order to focus attention on the spread of scores within groups. The middle horizontal lines, which represented the average scores in Figures 5-10, are omitted.

Figure 11 compares the composite achievement of boys, girls, and all students in grade 5. The figure shows that composite achievement scores for girls tend to be higher than those for boys. For girls, the grade equivalent score for the 25th percentile is approximately 4.50, while for boys, it is approximately 4.25. A similar relationship holds at the 75th percentile where the grade equivalent score for girls is approximately 6.40 and for boys 6.00. The spread of scores at the fifth-grade level is illustrated by the fact that the middle 50 percent of all students ranges from approximately 4.40 to 6.25 grade equivalent scores in composite achievement.

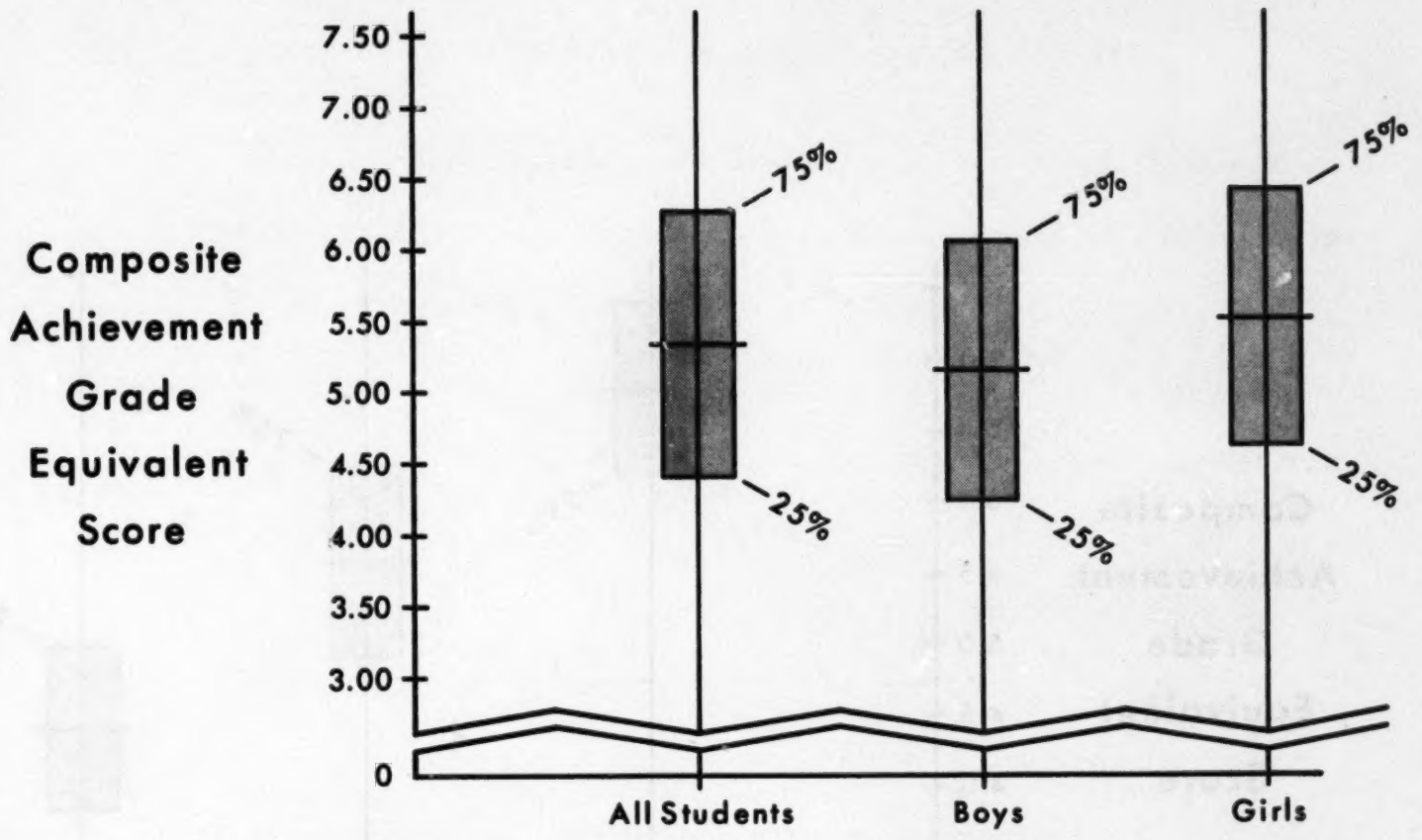


Figure 11. Comparison of Composite Achievement by Sex, Grade 5

The relationship between I.Q. and scholastic achievement is illustrated in Figure 12. The 25th percentile of the high I.Q. group (I.Q. 120 and above) is approximately the same as the 75th percentile of the middle I.Q. group (I.Q. 100-119) and is more than one grade equivalent score above the 75th percentile of the low I.Q. group (I.Q. 99 and below). Thus, it can be seen that almost 75 percent of the high I.Q. group but only about 25 percent of the middle I.Q. group scored above the 6.2 grade equivalent score in composite achievement. A similar relationship in achievement is shown between the middle I.Q. group and the low I.Q. group.

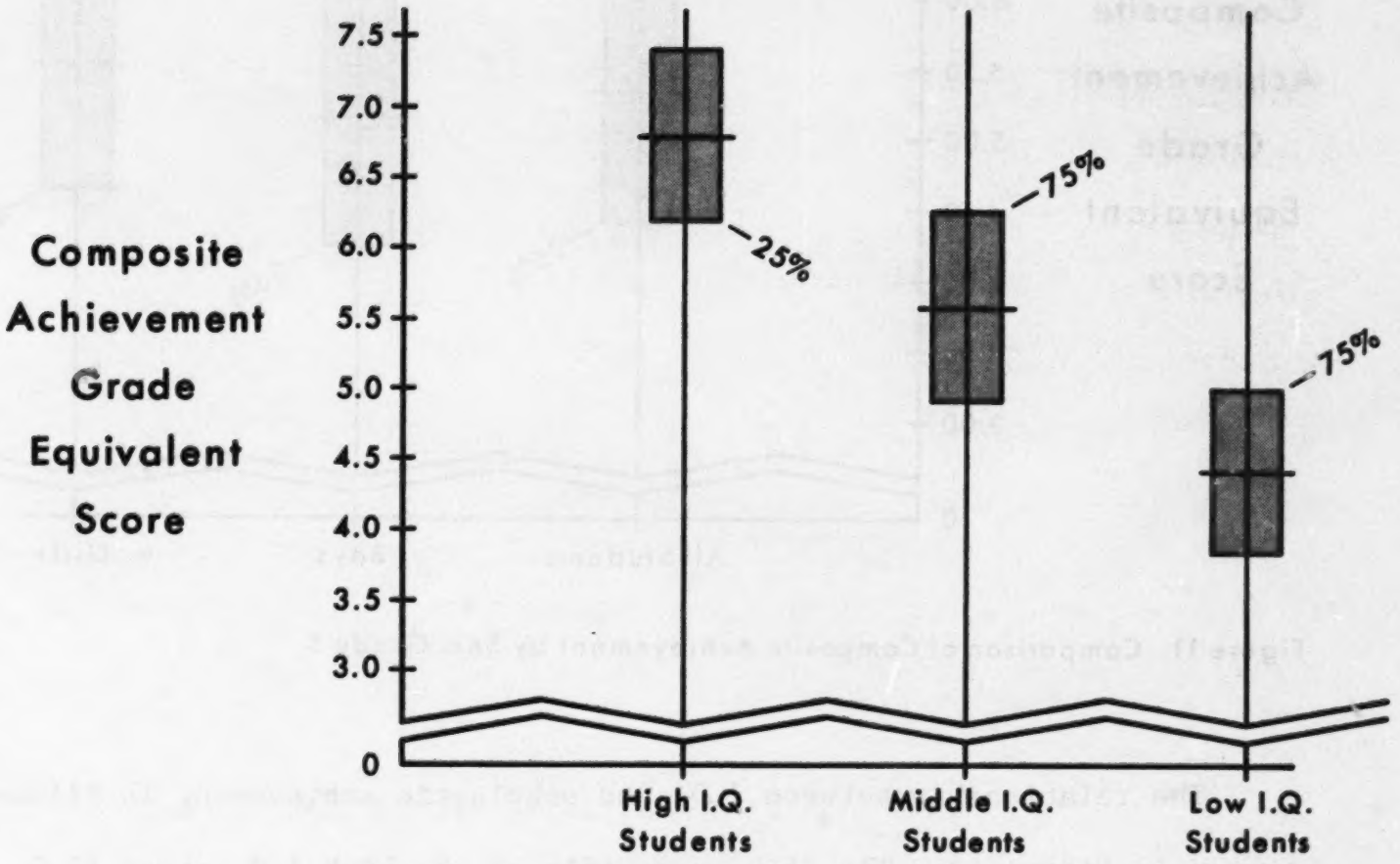


Figure 12. I.Q. and Composite Achievement, Grade 5

The three methods of grouping by socioeconomic level--mother's education, father's education, and father's occupation-- show similar relationships. The higher the educational level of either parent, or the occupational level of the father, the higher the achievement level of the students (Figures 13-15).

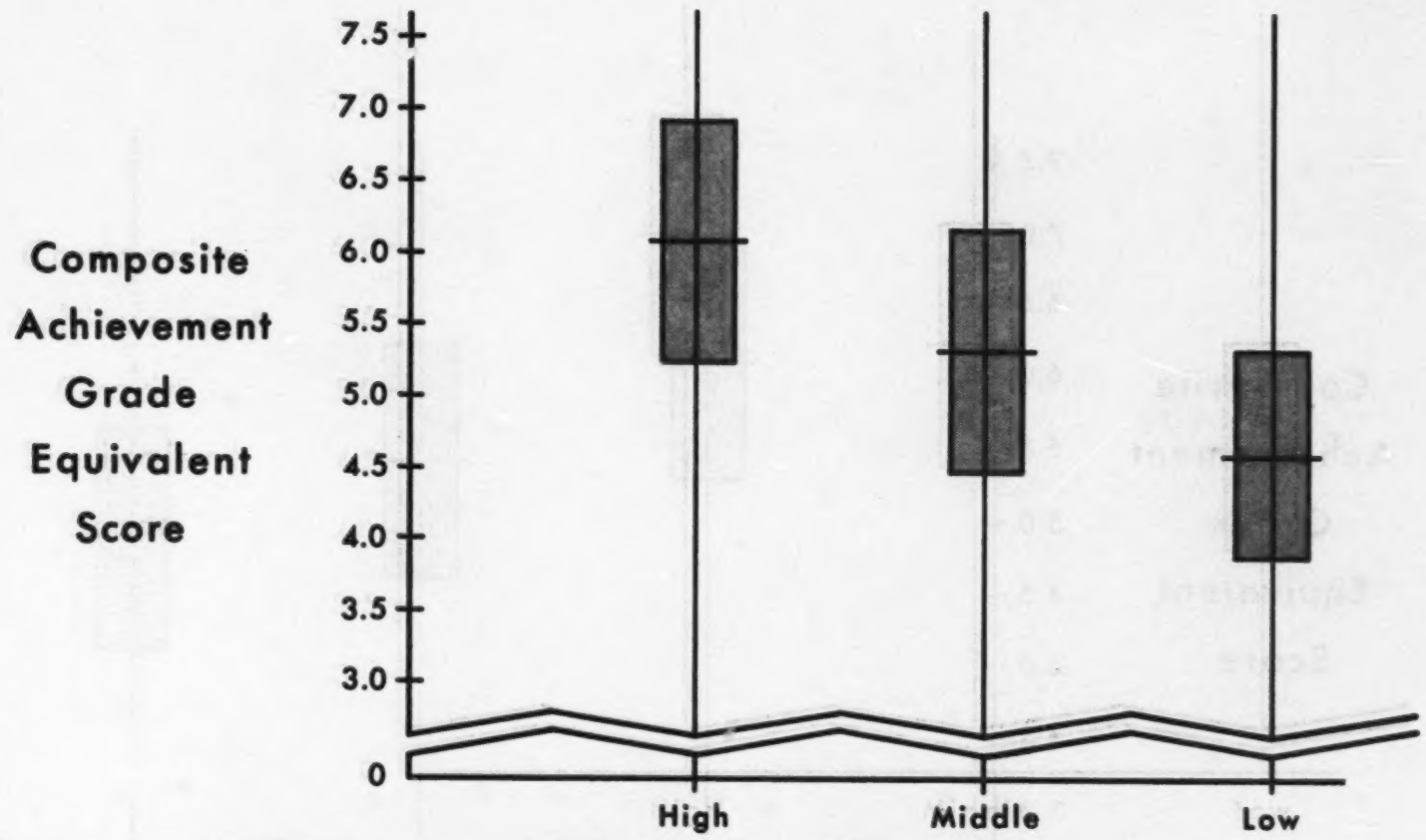


Figure 13. Mother's Education and Composite Achievement, Grade 5

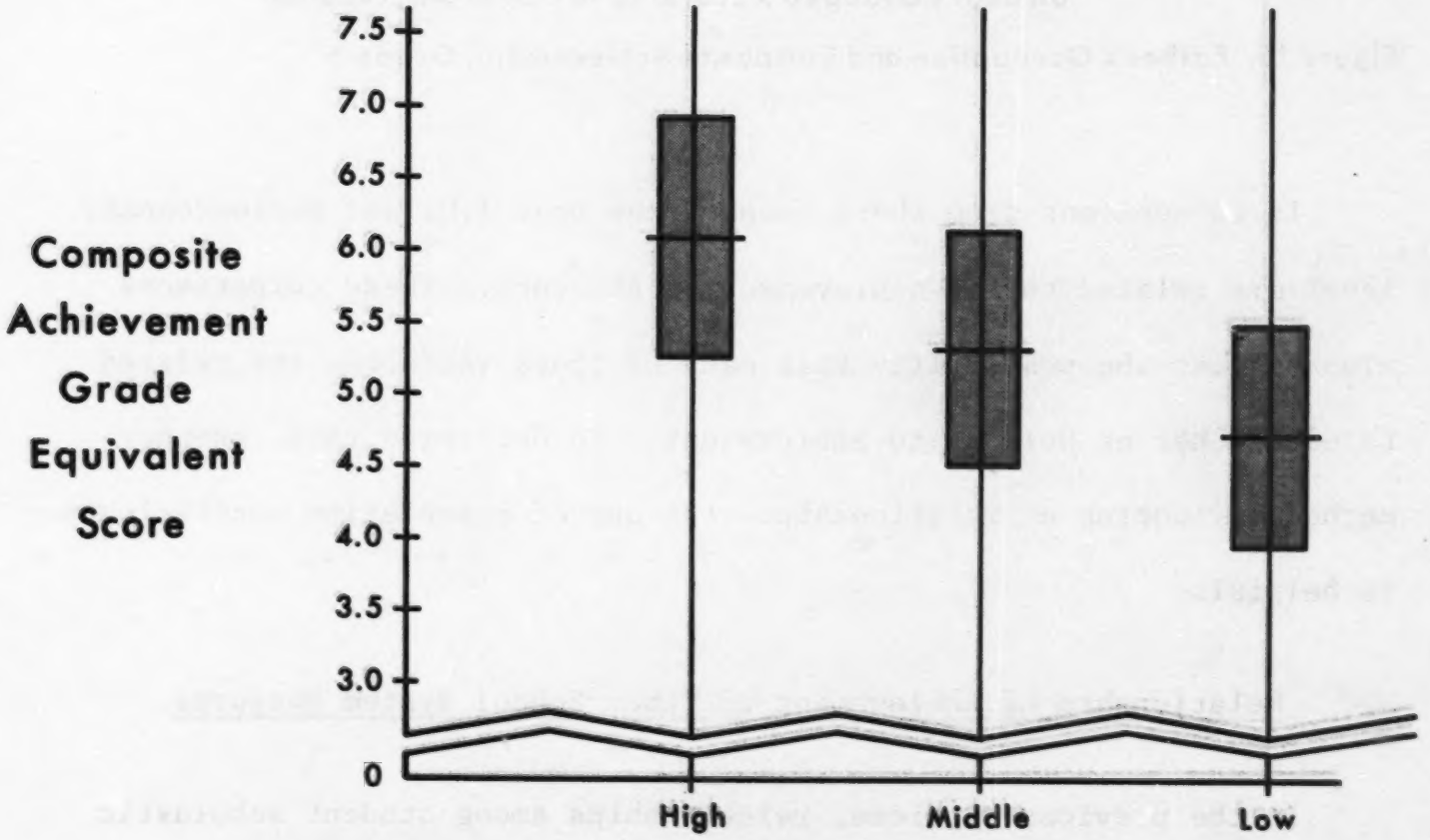


Figure 14. Father's Education and Composite Achievement, Grade 5

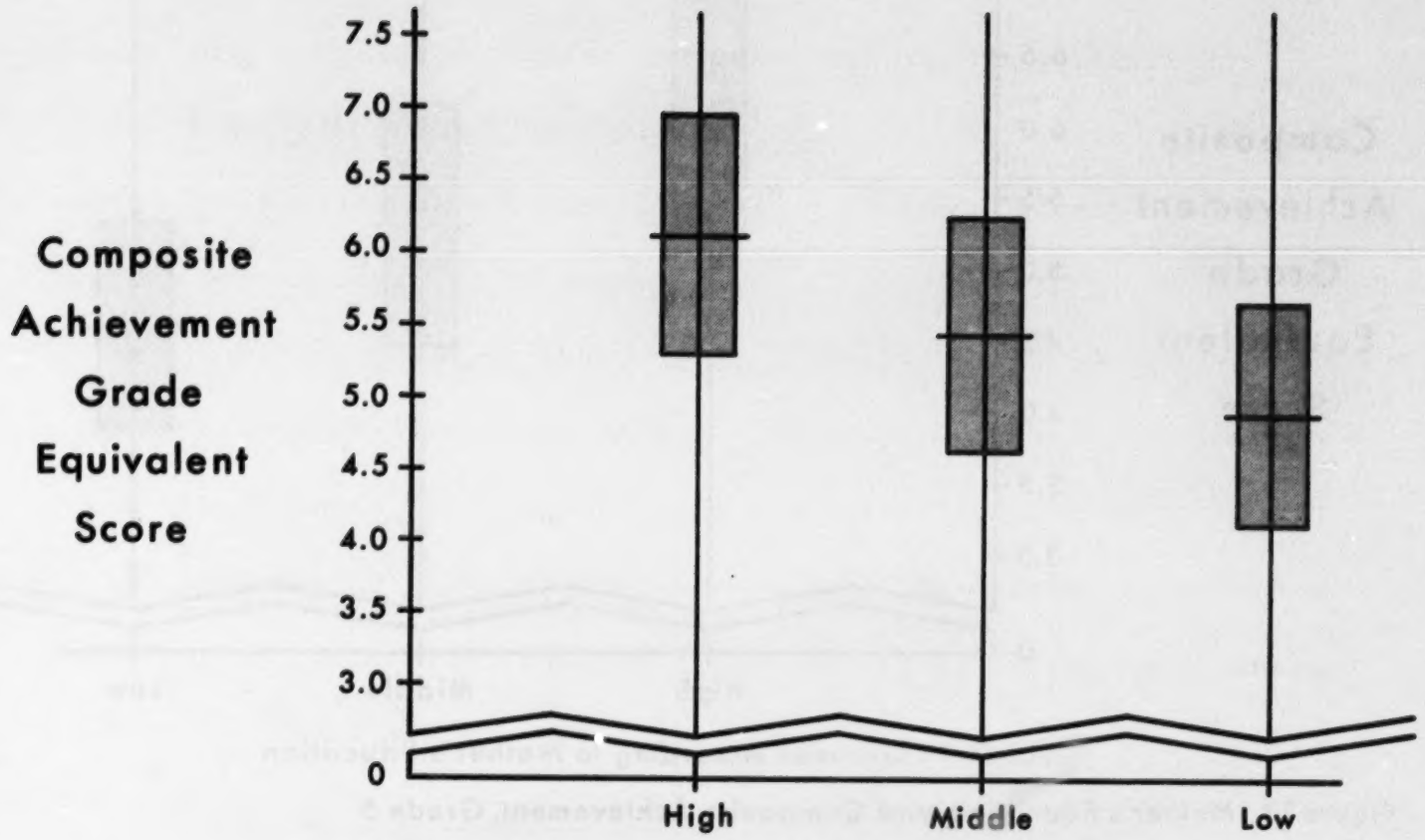


Figure 15. Father's Occupation and Composite Achievement, Grade 5

It is apparent from these comparisons that I.Q. and socioeconomic level are related to the achievement of students. These comparisons also suggest the possibility that many of these variables are related to each other as well as to achievement. To determine this, another method of looking at relationships--the use of correlation coefficients--is helpful.

Relationship of Achievement to Other School System Measures

In the previous sections, relationships among student scholastic achievement, various pupil and parental background characteristics,

school system average achievement, and community conditions have been presented in the form of visual figures. These same relationships can be presented in tabular form in terms of correlation coefficients.

Correlation coefficients express relationships on a continuum from + 1.00 through -1.00. A positive relationship is indicated by coefficients between zero and +1.00 and reflects a direct relation between two happenings. For example, an increase in pressure on the accelerator of an automobile is related to an increase in the speed of the automobile. A zero order correlation indicates that no relationship exists. Negative correlation coefficients indicate that an increase in one of the measures is related to a decrease in the other. For example, the greater the number of people vaccinated against polio, the fewer cases of sickness and death due to the disease. However, in educational data one occurrence cannot necessarily be assumed to cause the other, as they might in these examples.

Correlation coefficients are traditionally reported in the form of tables similar to those which appear on road maps, whereby the distance between two cities may be determined, and the table is read in the same way. In order to develop Table 1, it was first necessary to obtain a "score" for each school system on each of the variables being studied. For variables 1-7 in the table, the scores were averages of the scores for individual students within the school system. The variables were described earlier. For variables 8 and 9, expenditure figures for each school system were used. Total expenditures include all the money a system spends in the operation of its schools. Approved operating expenditures omit such expenses as transportation

(buses), payments on bonds, tuition to other districts, and school lunches. Thus, approved operating expenditures are more descriptive of the day-to-day expenses involved in operating an instructional program.

Table 1 shows a correlation coefficient of .89 (a strong positive relationship) between average father's education and average mother's education for the 99 school systems studied. (In this table, the plus signs have been omitted from positive correlation coefficients.) Nearly as strong a relationship (.85) is seen between average father's education and average father's occupation. The relationship of .61 between average mother's education and average father's occupation is not quite so strong but still substantial.

The average I.Q. shows a fairly strong relationship to nearly all of the other school system averages used in this study with the exception of the expense variables. The parental educational and occupational averages correlate .71, .72, and .61 with I.Q. The school system averages for reading, arithmetic, and composite achievement correlate .76, .60, and .74, respectively, with average I.Q.

Correlation coefficients between the three achievement measures and the parental educational and occupational averages range from .37 to .72.

Average reading and arithmetic achievement could be expected to be related to average composite achievement because each is included in the calculation of the composite score. Thus, the high correlation coefficients of .97 and .92 are no surprise.

Total expenditures and approved operating expenditures both show rather weak positive relationships with all the other average measures.

Table 1

Correlation Matrix of School System Averages
Grade Five
n=99 school systems

	1 Aver. M. Ed.	2 Aver. F. Ed.	3 Aver. F. Occ.	4 Aver. I.Q.	5 Aver. Reading Ach.	6 Aver. Arith. Ach.	7 Aver. Comp. Ach.	8 App. Oper. Exp.	9 Total Exp.
1 Average Mother's Education		.89	.61	.71	.72	.48	.65	.34	.21
2 Average Father's Education	.89		.85	.72	.69	.48	.65	.44	.31
3 Average Father's Occupation	.61	.85		.61	.52	.37	.49	.38	.27
4 Average I.Q.	.71	.72	.61		.76	.60	.74	.31	.22
5 Average Reading Achievement	.72	.69	.52	.76		.85	.97	.26	.17
6 Average Arithmetic Achievement	.48	.48	.37	.60	.85		.92	.12	.09
7 Average Composite Achievement	.65	.65	.49	.74	.97	.92		.22	.16
8 Approved Operating Expenditures	.34	.44	.38	.31	.26	.12	.22		.77
9 Total Expenditures	.21	.31	.27	.22	.17	.09	.16	.77	

Eighth-grade correlation coefficients are not presented here, but they show a pattern similar to that in Table 1.

Two important features of Table 1 should be pointed out. First, all of the correlation coefficients are positive. Second, the degree of interrelationship among measures is particularly striking. For this reason, the independent relationships between variables cannot be determined from the data reported here.

The strength of the relationships of socioeconomic and I.Q. measures to achievement measures as shown in the figures and in the correlation matrix suggests that any valid evaluation of school system effectiveness based upon achievement must take into consideration the I.Q. and socioeconomic backgrounds of the students. Comparisons of school system average achievement scores based solely upon national averages, Regents Examinations, or statewide examinations, without considering variables such as those dealt with here, could be quite misleading. This study has identified some, but certainly not all, of the factors related to achievement.

Evaluation of School System Achievement

A major purpose of the second Quality Measurement Project was to develop more appropriate methods by which school officials might compare the academic achievement of students in one school system with that of students in other systems. Although still rather crude, several methods were devised, making use of the relationships illustrated in preceding sections. Three methods of school system evaluation will be described briefly.

The first method of school system evaluation based on academic achievement is accomplished by comparing school system average scores

with several norms. The norms are based on average achievement scores of school systems grouped according to the communities and students they serve. These are illustrated in Figure 16. Each column in the figure provides achievement norms for a specific group of school systems. For example, the first column, Total N.Y. State, represents achievement norms for all systems in the study; the second column represents achievement norms which are applicable to large and medium size city school systems. Thus, it is possible to compare the average achievement score of a school system with those of all systems in the study and also with systems grouped according to community type, father's education, mother's education, father's occupation, and three measures of I.Q. The columns under these headings which may be selected for use in making comparisons should be those most closely resembling the school system being studied, and should be selected on the basis of information available or collected on the system.

Each column is divided into four parts to indicate the distribution of school system average achievement scores for systems in that group. The achievement scores of the lowest 25 percent of the school systems in that group fall in the lower shaded area; the scores of the second 25 percent, in the lower white area; the scores of the third 25 percent of the school systems fall in the upper white area; and the scores of the highest 25 percent, in the upper shaded area. The line separating the two white areas represents the average achievement score for systems in that particular group.

Each achievement area would be represented by a different chart similar to Figure 16, which represents composite achievement.

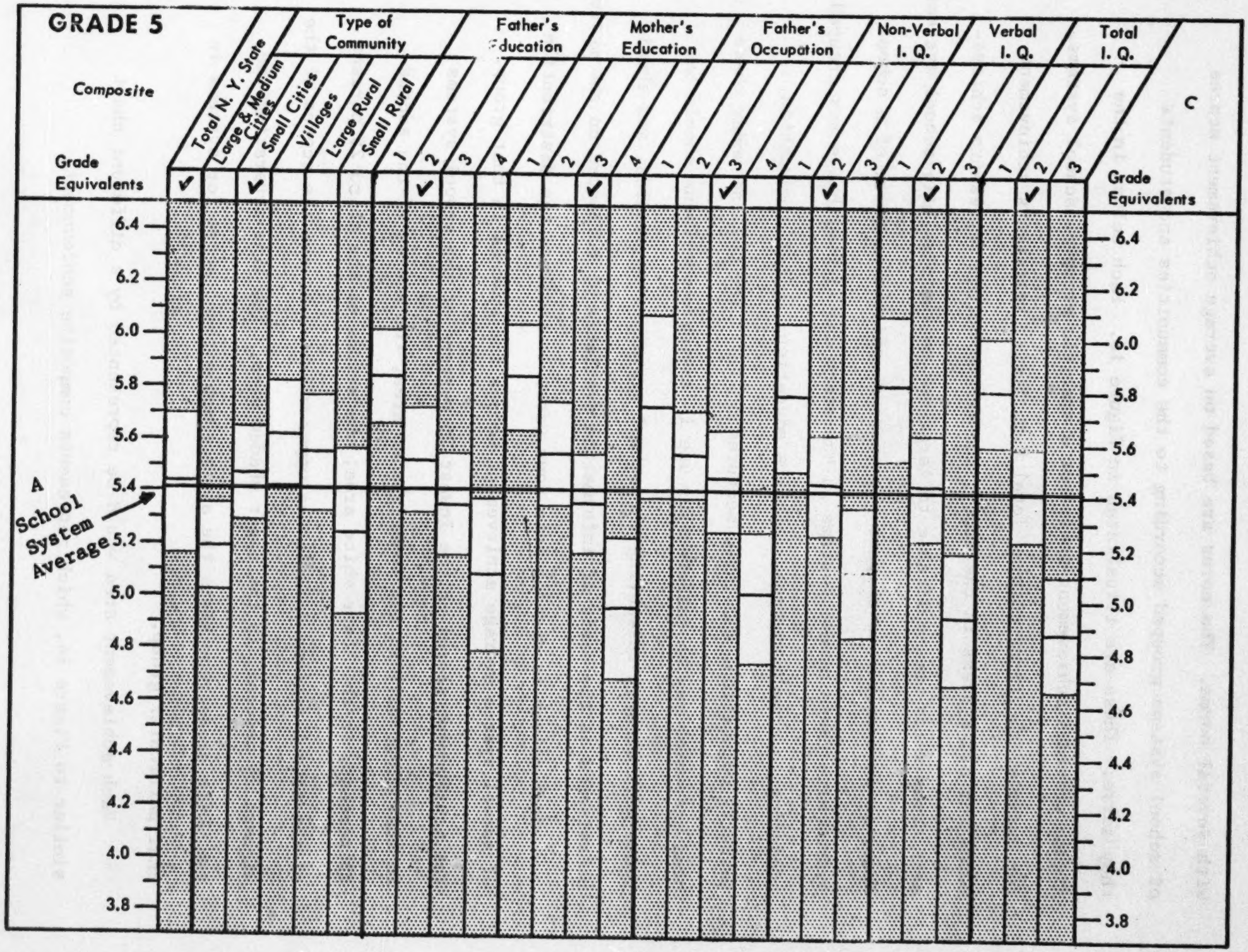


Figure 16. Comparison of School System Composite Achievement Averages.

A hypothetical example using the chart in Figure 16 may clarify the use of the chart. The average composite achievement score of 5.41 for fifth-grade students in a hypothetical school system is represented by the line drawn across all columns in the chart. The columns which are checked (✓) are those representing groups of systems mos t closely resembling the hypothetical school system.

The line representing composite achievement for the hypothetical school system passes through the second quarter of the columns for Total N.Y. State, Small Cities, and those checked under Father's Education, Father's Occupation, Nonverbal I.Q., and Verbal I.Q. That is, composite achievement for the hypothetical system was somewhat lower than the average for each of these groups of school systems. The line passes through the third quarter of the column checked under Mother's Education, indicating that composite achievement for the hypothetical system was somewhat above the average for systems in that column. The line passed through the average of the second column under Total I.Q., indicating that the average composite achievement score for the hypothetical system is the same as that for systems represented by that column. A workbook, Appraising School Performance Through Student Achievement in Basic Skills, is being prepared for publication. It will explain the methods of determining school system type as used in Figure 16. It will also contain normative tables, figures, and directions for using the workbook to assess school system performance.

Another method of evaluating school system effectiveness is in terms of the achievement of certain groups of students. More specifically, students are divided into groups according to a background measure, such as the educational levels of their mothers. The achievement of each

of the groups is then compared with that of students grouped in the same way. For example, if mother's education is the background measure, the achievement of the students in a school system whose mothers have a high educational background is compared with that of all students in the State who have mothers of high education levels. Achievement of students within a school system with mothers of middle education levels and those of mothers of low education levels would be compared only with students grouped in the same way.

Comparison in every case is in terms of the percent of students whose achievement scores are better than 75 percent of the students in the State and also the percent achieving more poorly than 75 percent of the students in the State.

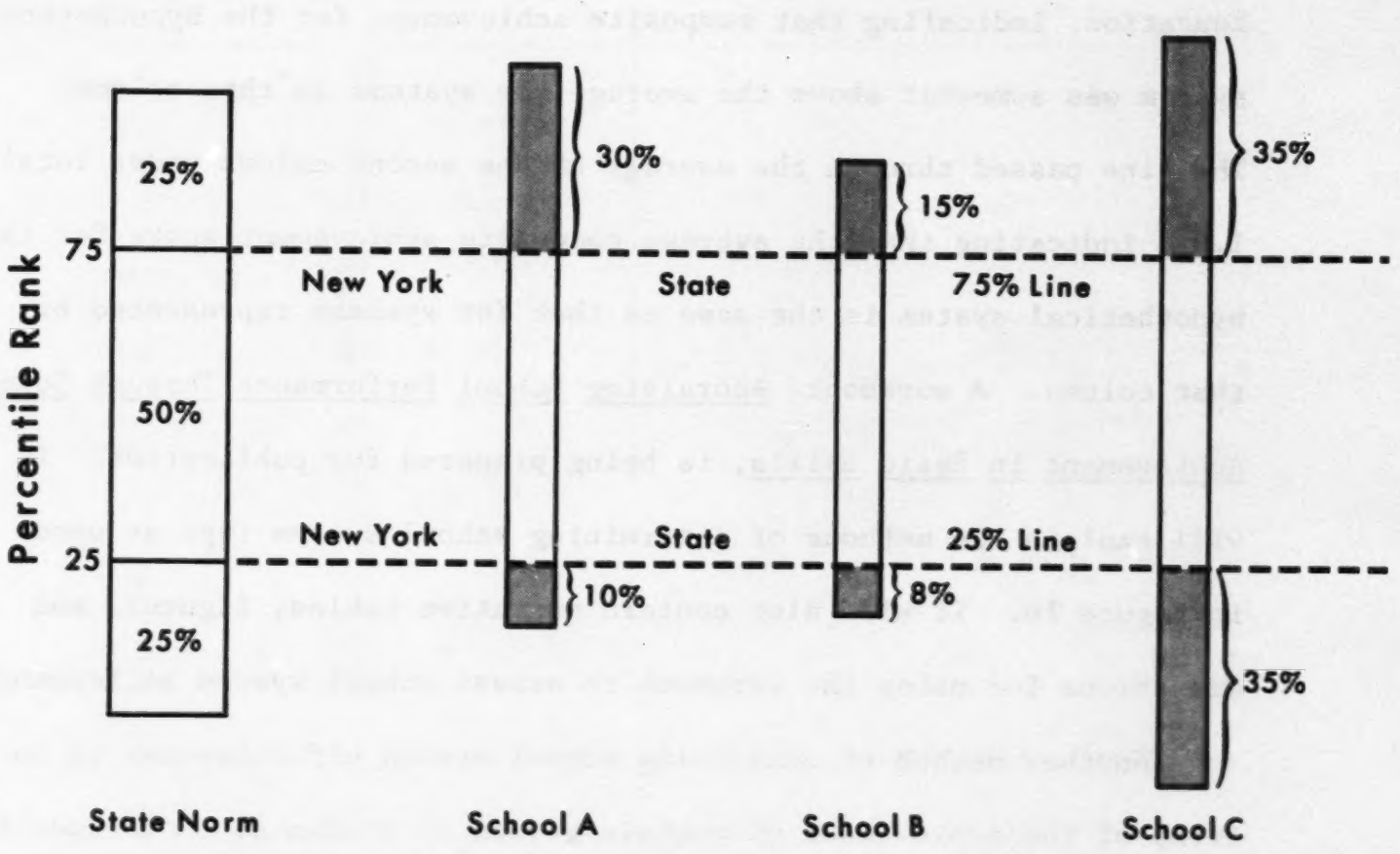


Figure 17. Comparison of a Sub-group of Students in Several Schools

Figure 17 illustrates the possibilities of this method. Assuming that we are studying the achievement of students whose mothers fall in the high education group, officials of School A would discover that those students are achieving better at both the top and the bottom of the distribution than similar students across the State. Five percent more students (30 percent for School A minus 25 percent for the State group) fall at the top of the column and 15 percent fewer (25 percent for the State group minus 10 percent for School A) fall at the bottom of the column.

School B has fewer students at both extremes than the State group, while school C has more. Further examination of schools B and C might reveal whether the differences in the distribution of achievement scores reflect differences in ranges of abilities of students in the schools or in the effectiveness of the schools with specific subgroups of students.

Similar comparisons are possible in each subject area for groups of students whose mothers fall in the middle and lower levels of education and for students grouped according to other socioeconomic and I.Q. measures. The above method will also be illustrated in the forthcoming workbook.

The third method of achievement analysis is quite similar in content to the first in that school system averages are used. However, in this method the important background measures are considered simultaneously. The various measures are weighted in relation to each other by the statistical procedure of regression analysis. The resultant mathematical equation can be converted into a table known as a nomograph. Although the equation can be used to predict an achievement score, the use of

nomographs requires practically no mathematical skill yet at the same time allows visual comparison of the relationships of the various measures used.

Nomographs are especially valuable because they permit simple handling of intricate relationships. A nomograph is presented in Figure 18 to illustrate the prediction of average composite achievement for grade five of a hypothetical school system. To obtain the predicted score, the average I.Q. for the system (105) is first located and marked on the first vertical line on the left. The average instructional cost ($460) is then located and marked on the scale second from the right. The two points are then connected with a straight line, as illustrated by the dotted line on Figure 18. Average mother's education (3.9) of the system is next located and marked on the scale on the right. This last point is joined with the point at which the first dotted line crossed the unscaled vertical line. The last connecting line crosses the average achievement line at the predicted score for the system. In Figure 18, the predicted score is 5.4.

School administrators using this method of evaluation would then compare the actual average achievement score of their system as measured by the Iowa Tests of Basic Skills, to the predicted score as found on the nomograph. The result would reveal whether their system was achieving better or poorer than predicted.

Average achievement scores which are as close as .14 (one standard error) to the predicted value can be considered to be the same as the predicted score. Those which differ from the predicted value by as much as .14 probably indicate real differences. Of course, the greater the difference between the predicted score and the actual score,

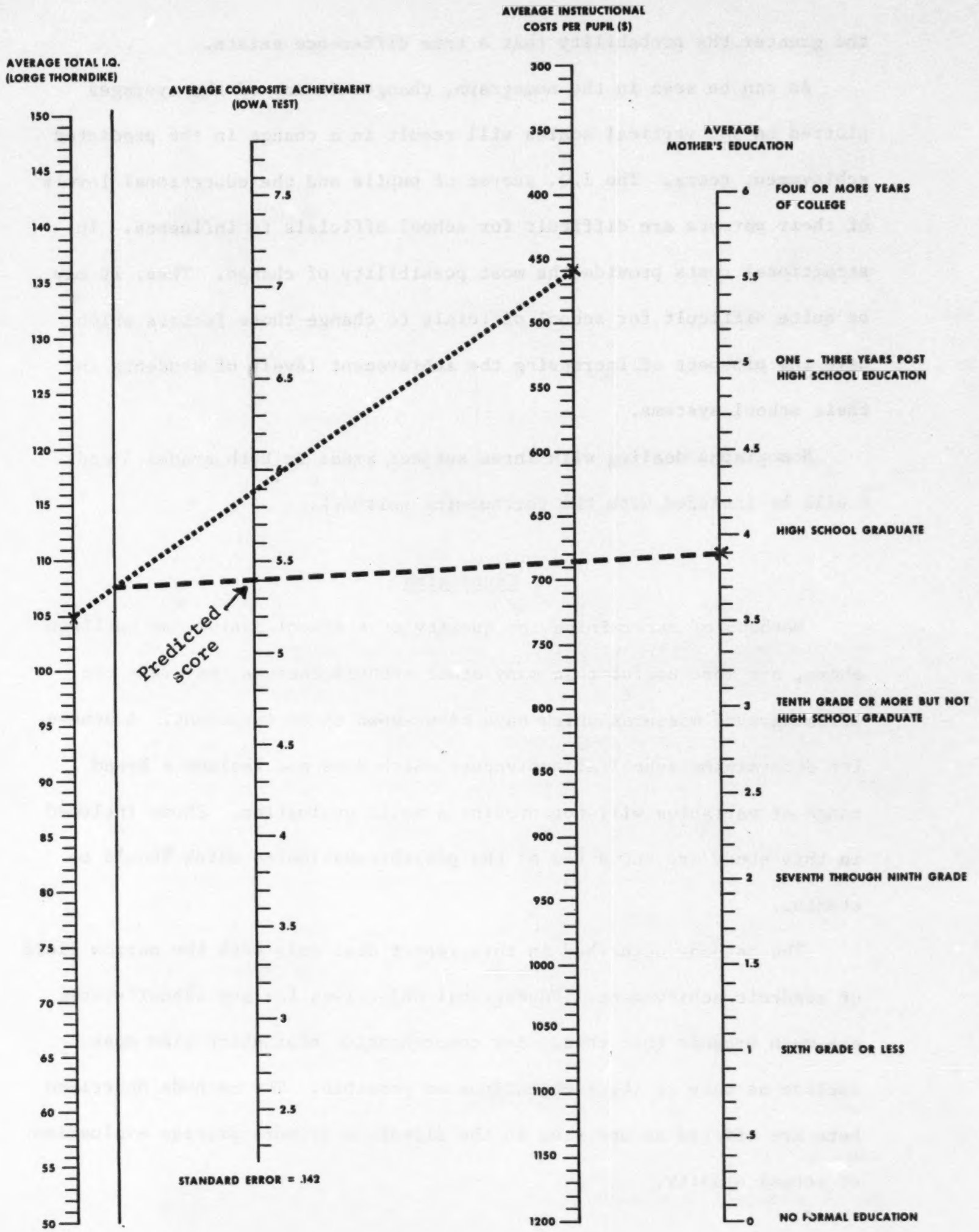


Figure 18. Nomograph of School System Average Fifth-grade Composite Achievement

the greater the probability that a true difference exists.

As can be seen in the nomograph, changes in any of the averages plotted on the vertical scales will result in a change in the predicted achievement score. The I.Q. scores of pupils and the educational levels of their parents are difficult for school officials to influence. Instructional costs provide the most possibility of change. Thus, it may be quite difficult for school officials to change those factors which have the prospect of increasing the achievement levels of students in their school systems.

Nomographs dealing with three subject areas in both grades 5 and 8 will be included with the forthcoming workbook.

Conclusion

Methods of determining the quality of a school system, as outlined above, are more useful than many other methods because they make use of background measures which have been shown to be important. A scheme for determining school effectiveness which does not include a broad range of variables will not provide a valid evaluation. Those included in this study are but a few of the possible variables which should be studied.

The methods described in this report deal only with the narrow field of academic achievement. Educational objectives for any school system are much broader than this. Any comprehensive evaluation plan must include as many of these objectives as possible. The methods described here are offered as one step in the direction of more precise evaluation of school quality.